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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/632,111	08/01/2003	Omur M. Sezerman	Sezerman	3481

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EXAMINER	
BOUTSIKARIS, LEONIDAS	
ART UNIT	**PAPER NUMBER**
2872	

DATE MAILED: 09/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/632,111	SEZERMAN ET AL.	
	Examiner	Art Unit	
	Leo Boutsikaris	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,11-36,53,54 and 58-60* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *59 and 60* is/are allowed.

6)☒ Claim(s) *1-9,11-36,53,54 and 58* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

Acknowledgment is made of applicant's claim for foreign priority based on an application No. 2,396,831 filed in Canada on 8/2/2002. It is noted, however, that applicant has not filed a certified copy of the above application as required by 35 U.S.C. 119(b).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-4, 6, 8-9, 11-16, 18, 20-28, 30, 32-36, 53-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kouta (US 2001/0021293) in view of Dugan (US 2002/0085824) and Cho (SPIE article).

Regarding claims 1, 8, Kouta discloses a method for creating a zone of permanently altered refractive index characteristics in an optical waveguiding device made of glass material and having core 12 and surrounding cladding in a substrate 11 (Fig. 1), using a focused laser beam from a pulsed laser source wherein the wavelength is 800 nm (beyond the absorption edge of the glass material which is around 300 nm); the pulse width is 150 femtoseconds (less than 1 picosecond); the pulse energy is 0.1 microjoule; the laser beam having a peak intensity at a

defined focal region 15; and wherein the repetition rate of the pulsed laser beam is selected so that the applied heat softens the material and induces permanent refractive index changes in the waveguiding device. ([0042], [0064]-[0073]). It is noted that as the focal region is scanned along the device there is an underlying aligning of the focal region with a defined target region.

However, in Kouta's method, the pulsed laser alters the refractive index of an existing waveguiding device, and does not create a new optical waveguiding device. Dugan discloses a method of writing refractive index profiles in materials using femtosecond laser pulses (Fig. 1), wherein it is taught that the pulsed laser may change the refractive index of an area *outside* an existing waveguiding device, for example for creating a tap region near a waveguide to couple light from and to the waveguide ([0020]). It would have been obvious to one of ordinary skill in the art at the time the invention was made to focus the pulsed laser on an area proximate to an existing waveguide, as taught by Dugan, for creating a new waveguide, which may be used in conjunction with the existing waveguide to perform some operation such as light coupling.

In addition, the waveguide in Kouta's method is planar and not an annular optical glass fiber having a core and a cladding. Cho discloses a method for modifying optical glass fibers using pulsed lasers, wherein the refractive index of an annular optical fiber is altered by using the laser radiation (Fig. 1). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the pulsed laser of Kouta to modify the properties of a region of an optical fiber, as taught by Cho, since optical fibers are the most widely used waveguiding devices in many sectors, such as telecommunications, sensing, imaging etc.

Regarding claim 2, the focal region is oriented perpendicularly relative to the longitudinal axis of the core (see Fig. 1), and Kouta discloses that spectrometric measurements of the

waveguide are taken before and after illumination to monitor the refractive index change in the device.

Regarding claim 3, the pulse repetition rate is 200 KHz ([0066]).

Regarding claim 4, the laser source is based on Ti-sapphire gain material ([0066]).

Regarding claim 6, the laser beam is focused onto the waveguiding device via the use of a lens 14.

Regarding claim 9, Kouta discloses that the pulse repletion rate of 200 KHz is selected so that the pulses deliver heat quickly enough to soften the material locally ([0042]-[0045]).

Regarding claim 11, the energy of the pulse is 10^{-7} J, the duration is $150x10^{-15}$ s, and the area is πxr^2, where $r=3.5x10^{-4}$ cm. The resulting peak intensity per pulse is $18x10^{13}$ W/cm^2.

Regarding claim 12, the optical fiber where zones of permanent refractive index are written is a conventional optical fiber (see Fig. 1 in Cho).

Regarding claims 13-16, 18, 21-28, 30, 33-36, Kouta discloses all the limitations of the above claims except for teaching that two separate focused laser beams are combined to increase the heat locally in the waveguiding device, thereby creating a permanent refractive index change. As described supra, Dugan discloses a method of writing refractive index profiles in materials using femtosecond laser pulses (Fig. 1), wherein it is taught that multiple scans overlapping each other within the waveguide can result in a larger induced change in the refractive index ([0016]). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine two separate laser pulses inside the waveguide of Kouta, for creating increased heat effects locally, without increasing the intensity of the laser sources.

Regarding claims 20, 32, Kouta in view of Dugan and Cho does not disclose the use of reflective optics to focus the pulsed laser beam. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use reflective focusing optics instead of a refractive lens, since Official Notice is taken that reflective optics is one widely used means for focusing light, having the advantage of lacking the various aberration effects of refractive lenses.

Regarding claims 53-54, Kouta in view of Cho discloses all the limitations of the above claims except for teaching that the focused short laser pulses are used to modify the refractive index properties of waveguiding devices so that there is improved coupling between neighboring waveguides or between a waveguide and an optical source. Dugan teaches that a region between two adjacent waveguides can be exposed to the short laser pulses, so that its refractive index profile is changed in such a way that there is improved coupling between the two waveguides (Fig. 10, line 31, col. 13 to line 22, col. 14). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Kouta's method to create a modified region adjacent the existing waveguide so that improved coupling between two adjacent waveguides occurs, as taught by Dugan, since this method utilizes existing components of the system to form a coupler and does not require separate couplers.

Claims 5, 7, 17, 19, 29, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kouta (US 2001/0021293) in view of Dugan (US 2002/0085824) and Cho (SPIE article) and further in view of Borelli (US 2003/0099452).

Kouta in view of Dugan and Cho discloses all the limitations of the above claims except for specifying the focal length and the numerical aperture of the lens 14 as well as size of the

beam spot at the focal point. Borelli discloses a method of creating waveguides in glass substrates by focusing femtosecond laser pulses on the substrates (Fig. 1), wherein it is disclosed that the objective lens 12 used to focus the light has a focal length of 20 mm and a NA of 0.28 ([0056]). The resulting beam spot has dimensions 1.3 microns by 2.3 microns. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a focusing lens in the system of Kouta in view of Dugan and Cho with the characteristics of the lens disclosed in the system of Borelli, for achieving a high optical intensity inside the target material, so that enough heat is accumulated locally to create a permanent refractive index change.

Claim 58 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kouta (US 2001/0021293) in view of Dugan (US 2002/0085824) and Cho (SPIE article) and further in view of Schaffer (US 2002/0162360).

Kouta in view of Dugan and Cho discloses all the limitations of the above claim except for teaching that there is an index matching fluid between the laser source and the optical fiber, so that the optical beam passes through the fluid prior to reaching the target region. Schaffer discloses a method for creating locally heated regions in photonic materials wherein the objective lens used to focus the light is immersed in oil ([0049]). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use an index matching fluid between the lens and the target region, as taught by Schaffer, for avoiding undesired Fresnel reflections between the various interfaces.

Allowable Subject Matter

Claims 59-60 are allowed.

Claims 59-60 are allowable over the prior art of record for at least the reason that even though the prior art discloses creation of permanent refractive index regions in photonic materials via the use of ultrashort laser pulses, the prior art fails to teach or reasonably suggest a method of creating an optical waveguiding device from an elongated generally annular optical fiber by creating a zone of permanently altered refractive index characteristics in the optical fiber, including the step of initially applying mechanical stress or an electric field to the optical fiber and then removing the mechanical stress or the electric field once the zone has been created, as set forth by the claimed combination.

Miura (US 6,154,593) and Dunn (US 6,853,785) disclose methods for modifying the refractive index in glass substrates using femtosecond long focused laser pulses.

Response to Arguments

Applicant's arguments with respect to claims 1, 13, 25 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Leo Boutsikaris whose telephone number is 571-272-2308.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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August 30, 2005

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